



Annual Reports :: Year 6 :: Pennsylvania State University

Project Report: Molecular and Isotopic Biogeochemistry

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Project Progress

Archean Biosphere

Based on an integration of lithologic, carbon isotopes, and molecular biomarker data, we documented evidence for diverse microbial ecosystems in marine environments during the late Archean (ca. 2.8–2.5 Ga). This work supports the existence of “oxygen oases” in shallow settings at that time, and demonstrates the gradual expansion of these environments into deeper waters during the 100 million years prior to events marking the oxidation of the atmosphere. This work is reported in Ono et al., 2003, and Eigenbrode, 2004 (Ph.D. thesis; several ms. in prep.).

Molecular and Isotopic Biosignatures

Using measurements of hydrogen isotopic compositions of individual biomarkers, my group has been exploring the utility and preservation of these signatures for paleohydrologic reconstructions (Pedentchouk, 2004; Ph.D. thesis) in early Cretaceous rift basin lakes along western Africa. An important finding in this work was that organic hydrogen exchanges with other hydrogen sources (such as formation waters, etc.) at temperatures approaching the oil window.

We have established methods for the analyses of lipids from Archaea using liquid chromatography–mass spectrometry. We have also evaluated numerous new methods for the isolation and isotopic analysis of microbial RNA. Both methods open up a wide spectrum of applications within microbial biogeochemistry. NSF provided a new grant to support the development of analyses of Archaea lipids for paleosalinity and other paleoceanographic applications.